Measuring the opening temperature of the two surviving Klixons

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I took the two surviving klixons (rated at 50C) to Lab 6 where I was helped by Ana Pla-Dalmau and Irina Kubantseva to use their oven using which one can set the temperature of the klixon in a controlled way. Figure 1 shows the set-up.

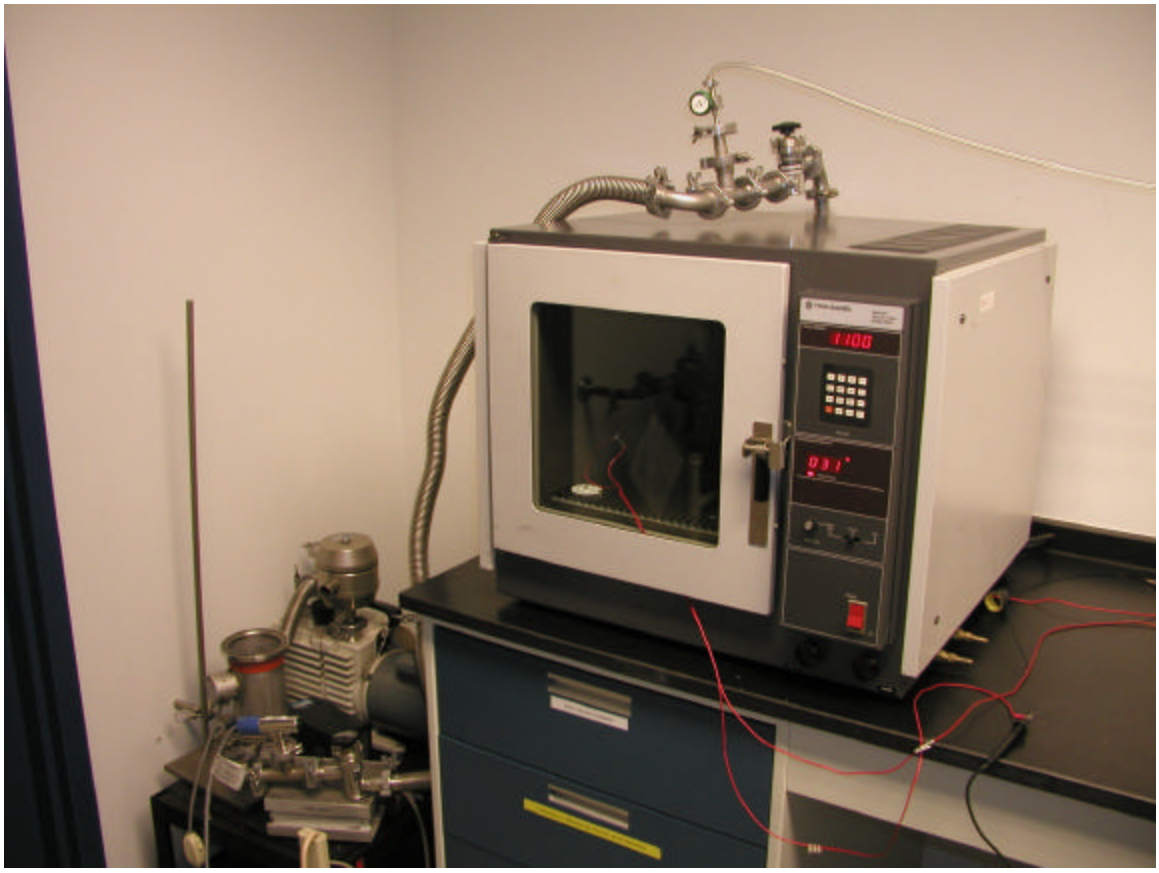


Figure 1 Oven with klixon in. The white object in the oven is a simple "coiled-spring" thermometer that measures the local temperature. The dial on the ove n in the middle RHS measures the temperature according to a device in the back of the oven.

The klixon is held up in the air by the lead wires. This simulates the setup in the RICH. The temperature was raised gradually from room temperature to a target temperature of 80 degrees Celsius. The resistance across the leads was monitored by a digital ohm meter. It read zero. As the temperature crossed 51 degrees Celsius, the klixon opened up. The oven door was opened (leading to different temperatures in the two thermometers) and the second klixon was substituted for the first. It opened when the "coiled spring" thermometer read 40 degrees C and the oven thermometer read 60 degrees C. The difference is due to the non-equilibrium conditions set up by opening the door.

Conclusions:- Both Klixons work. So the “smoke event” in the RICH was not caused by inadequate cooling produced by the air circulating downwards, since this would have cut the HV if the temperature exceeded 50 degrees C.

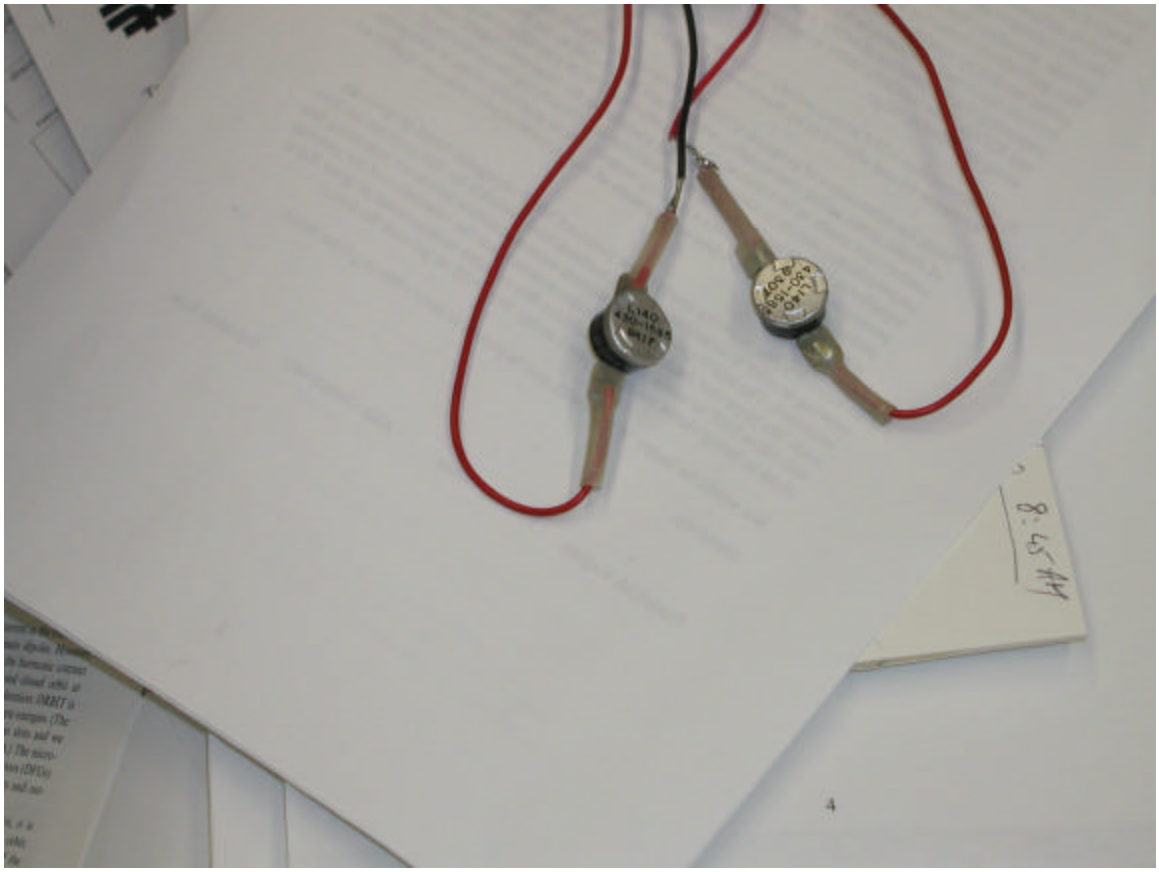


Figure 2 Undamaged klixons

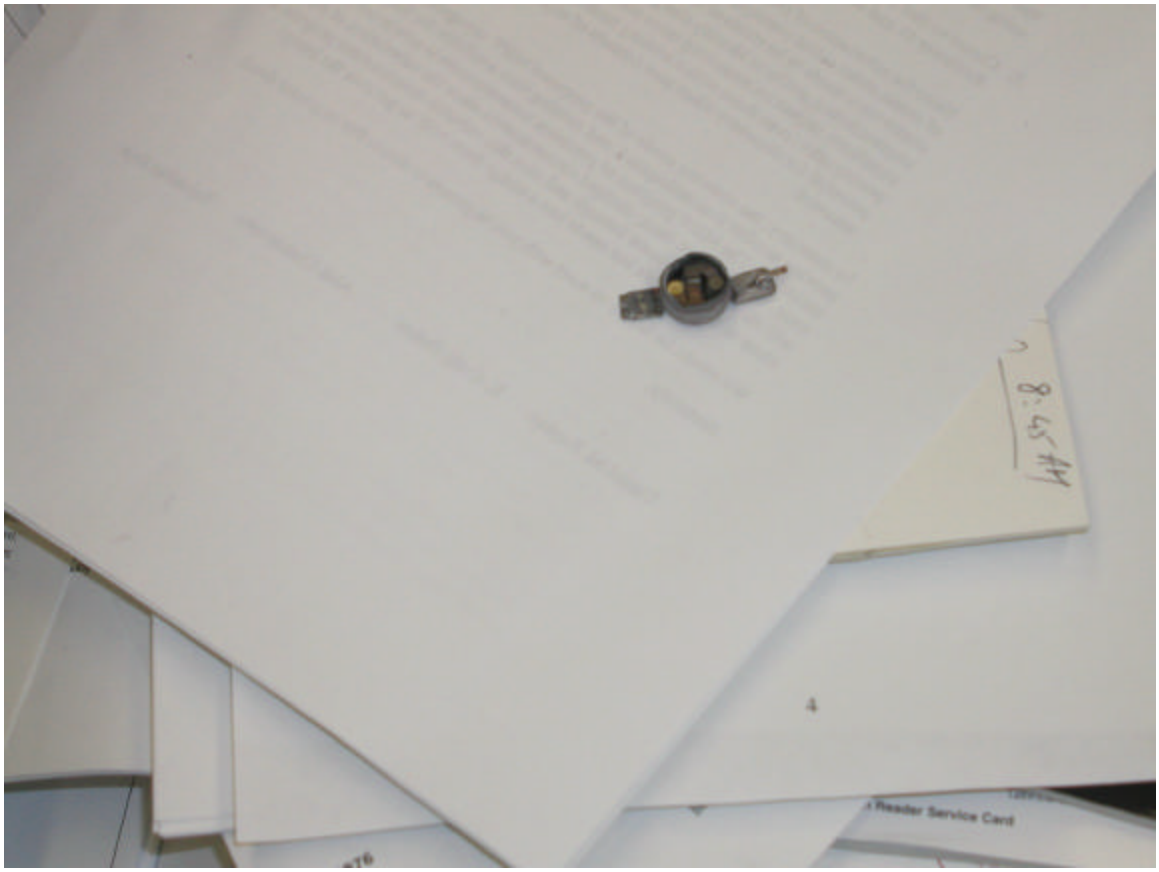
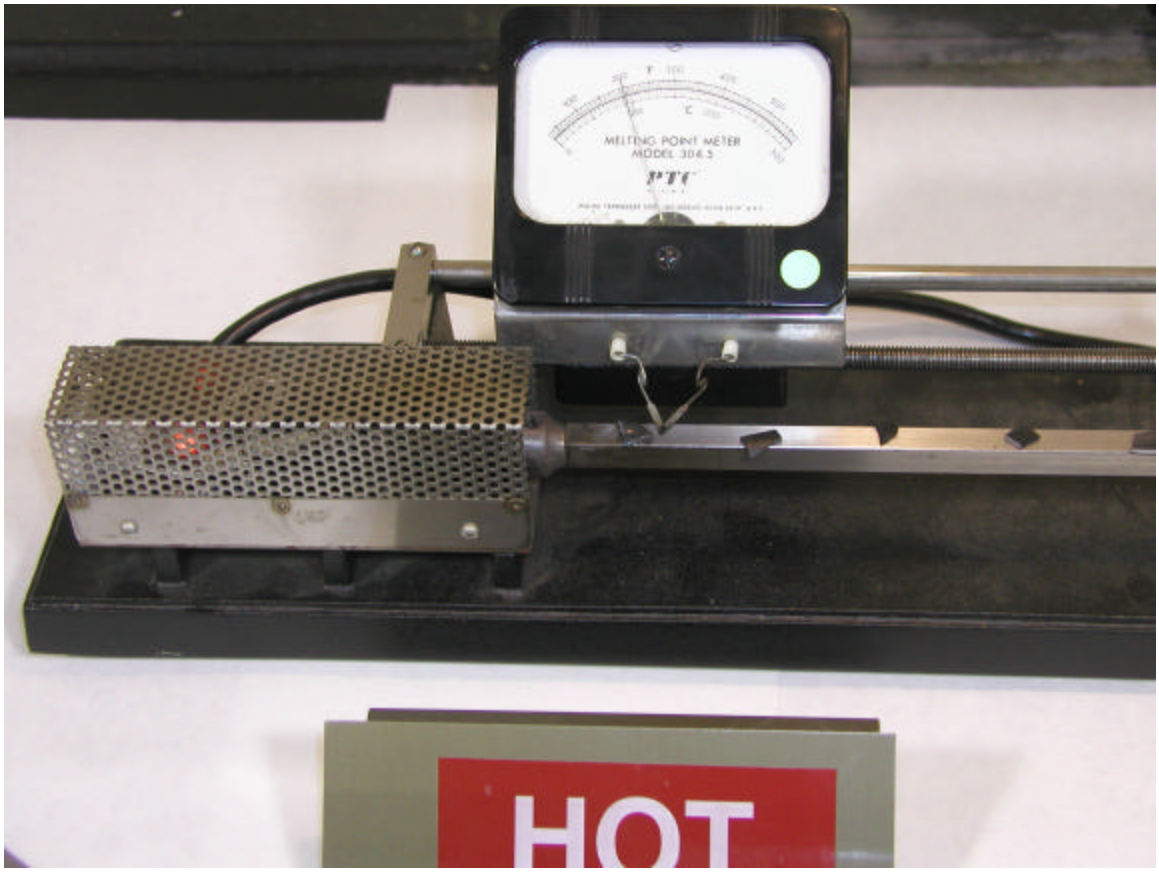


Figure 3 Damaged klixon

Melting point of insulation

I took a piece of the insulation wrapped around the cable bundles (rumored to be PTFE or Teflon) to Lab5 and used the device provided by Donna Hicks of the material lab to measure its melting point.

Figure 4 Device to measure melting point



Samples are placed on a rod that is heated gradually from one end. The temperature rises gradually at the left hand end. There is a temperature gradient across the bar. The temperature at any point in the bar can be measured by the sliding meter. There was also a thermocouple which could measure temperature.

Results:

Temperature Degrees C	Effect
153	Becomes plastic
160	Becomes more plastic
197	Almost molten
266	Black fumes emitted

Conclusion—The heat in the affected area was so intense as to melt the plastic. So it must have exceeded 266 degrees C. For the heat NOT to trigger the good klixons implies a very sharp heat gradient consistent with a fire and NOT a heating problem due to inadequate cooling.